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## **Risk factors for unfavorable pregnancy outcome in women with adverse childhood experiences**

Leeners, Brigitte ; Rath, Werner ; Block, Emina ; Görres, Gisela ; Tschudin, Sibil

**Abstract:** Aims: To explore the association between childhood sexual abuse (CSA), physical abuse, as well as other adverse childhood experiences (ACE), and different obstetrical risk factors/behaviors. Methods: In this cohort study, obstetrical risk factors and perinatal outcome in 85 women exposed to CSA were compared to 170 matched unexposed women. CSA, physical abuse, and ACE were explored by face-to-face interviews and by questionnaire. Data on perinatal outcome were extracted from medical charts. Fisher's exact, 2-test, and multiple logistic regression were used for statistical analysis. Results: During pregnancy women with CSA experiences were significantly more often smoking (31.7%/9.4%;  $P < 0.0001$ ), had partners abusing drugs (10.6%/1.2%;  $P < 0.0005$ ), experienced physical (16.5%/0;  $P < 0.0001$ ), sexual (12.9%/0;  $P < 0.0001$ ), and emotional abuse (44.7%/1.7%;  $P < 0.0001$ ), reported depression (24.7%/1.8%;  $P < 0.0001$ ), and suicidal ideation (10.6%/0;  $P < 0.0001$ ) than women without CSA experiences. Differences in risk factors were more often correlated with physical than with sexual abuse during childhood. The probability for premature delivery was associated with CSA, physical abuse and ACE as well as with several of the risk factors investigated. Conclusion: Women with CSA, physical, and ACE present with a variety of abuse-associated obstetrical risk factors and an increased risk for premature delivery. Therefore, all types of abusive and other ACE should be considered in prenatal care.

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# Risk factors for unfavorable pregnancy outcome in women with adverse childhood experiences

## Abstract

**Aims:** To explore the association between childhood sexual abuse (CSA), physical abuse, as well as other adverse childhood experiences (ACE), and different obstetrical risk factors/behaviors.

**Methods:** In this cohort study, obstetrical risk factors and perinatal outcome in 85 women exposed to CSA were compared to 170 matched unexposed women. CSA, physical abuse, and ACE were explored by face-to-face interviews and by questionnaire. Data on perinatal outcome were extracted from medical charts. Fisher's exact,  $\chi^2$ -test, and multiple logistic regression were used for statistical analysis.

**Results:** During pregnancy women with CSA experiences were significantly more often smoking (31.7%/9.4%;  $P < 0.0001$ ), had partners abusing drugs (10.6%/1.2%;  $P < 0.0005$ ), experienced physical (16.5%/0;  $P < 0.0001$ ), sexual (12.9%/0;  $P < 0.0001$ ), and emotional abuse (44.7%/1.7%;  $P < 0.0001$ ), reported depression (24.7%/1.8%;  $P < 0.0001$ ), and suicidal ideation (10.6%/0;  $P < 0.0001$ ) than women without CSA experiences. Differences in risk factors were more often correlated with physical than with sexual abuse during childhood. The probability for premature delivery was associated with CSA, physical abuse and ACE as well as with several of the risk factors investigated.

**Conclusion:** Women with CSA, physical, and ACE present with a variety of abuse-associated obstetrical risk factors and an increased risk for premature delivery. Therefore, all types of abusive and other ACE should be considered in prenatal care.

**Keywords:** Adverse experiences in childhood; childhood physical abuse; childhood sexual abuse; depression; intimate partner abuse; premature delivery; smoking.

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## Introduction

Consequences of abusive childhood experiences are associated with an increased risk for pregnancy complications, and may therefore, have a negative impact on pregnancy outcome [16, 17, 22]. The fact that at least one out of five women has been exposed to sexual abuse, and 29–78% to physical abuse during childhood support the relevance of such experiences in prenatal care [15, 16, 18]. In addition to abuse, other adverse childhood experiences (ACE), for example, burdensome life events/family structures, are likely to impair adult women's health [20, 26]. Currently, only a minority of these women seeks help to reduce the negative impact of such experiences on their life.

Health consequences of abuse-related problems, such as smoking, drug abuse, and depression, as well as difficulties with gynecological examinations are known in non-pregnant women with abusive or other ACE [26]. During pregnancy, they compromise not only the women's, but also the infant's health [11, 16]. Alcohol, for example, is a potent teratogen and its use during pregnancy is associated with fetal growth restriction, low birth weight, congenital anomalies, and perinatal death [22]. At the same time, women might be particularly motivated to avoid risk factors and risk behavior during pregnancy. However, only few scientific data on these associations have been published. As a result, obstetrician-gynecologists' understanding of potential consequences of childhood abuse experiences on subsequent pregnancies is rather limited. Consequently, current perinatal care does often not meet the specific needs of women exposed to abuse experiences. However, pregnancy is an important opportunity for primary prevention.

The intention of the present study was: (i) to investigate known obstetrical risk factors for unfavorable pregnancy outcome in women exposed to different adverse and abusive childhood experiences; (ii) to compare perinatal

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outcome in women exposed and not exposed to abusive experiences; (iii) to analyze the association between CSA, physical abuse as well as other ACE with regard to obstetrical risk factors during pregnancy and perinatal outcome. We hypothesized to find a higher number of obstetrical risk factors and a reduced fetal outcome in women with CSA, to show an association with obstetrical risk factors/fetal outcome at least partly independent from physical abuse experiences and/or other ACE. A high risk group, that is, women seeking psychological support, was chosen to better understand associations between different types of abuse experiences and obstetrical risk factors.

## Methods

The project was developed in cooperation with a team of the German “Frauennotruf”, an organization in all large German cities offering support for sexually abused women. The method of the study has

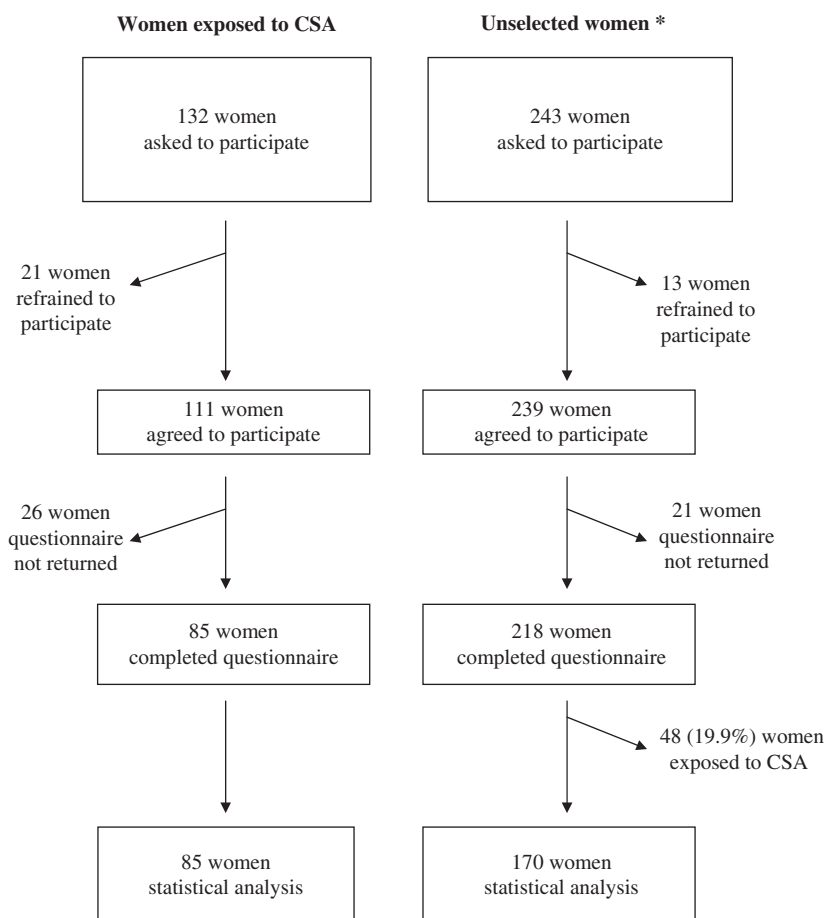
been previously described [17, 18]. Briefly, data on different obstetrical risk factors/behaviors and perinatal outcome (premature delivery, birth weight) from a cohort of 85 women with a history of CSA were compared to those of 170 matched women without CSA experiences.

## Recruitment and study population

Details on recruitment and participation are shown in Figure 1. Exposed and unexposed women had to have given life birth at least once prior to the study period. After women received information on details of the study and the voluntary participation, patient’s consent was obtained, and inclusion/exclusion criteria were verified. Major communication problems, cognitive or psychiatric disorders, which prevented informed consent and/or understanding of the questionnaire, were defined as exclusion criteria. Women were only included when they did not report a current pregnancy.

### Women with CSA experiences

Women exposed to CSA were recruited in cooperation with the support centers from the “Frauennotruf”. Each woman had an intensive



\* mothers from children in the kindergarten or presenting for routine gynaecological or dental care

**Figure 1** Recruitment of study participants. Women exposed to childhood sexual abuse and unselected women (mothers from children in the kindergarten or presenting for routine gynecological care).

nonstructured interview with a sexual abuse specialist working at the abuse center that lasted for at least 3 h and focused on the abuse situation. A staff member explained the aims and methods of the study. All women presenting with CSA experiences at one of the nationwide support centers within an 18-month study period were asked to participate. Inclusion criteria for exposed women were exposure to CSA and ongoing or past psychological support to cope with such experiences.

### Control group

Women without CSA experiences were recruited in several local kindergartens and from healthy women presenting for annual routine controls in different gynecological or dental offices. Women were only included in the control group when there was no history of CSA and when their age at the index-pregnancy, and number of children matched, with one of the exposed women. The index-pregnancy was defined as the first pregnancy resulting in a live birth. In all women, only experiences during the index pregnancy were included in the present study. These women were targeted as counterparts to reduce selection bias due to social status, as nearly all children attend kindergarten and nearly all women perform annual dental and/or gynecological check-ups. For every woman exposed to CSA, two unexposed women were selected.

### Questionnaire

The regular interviews performed at the support centers were used to diagnose CSA, physical abuse experiences, and other ACE. CSA experiences were additionally explored using questions modified from a questionnaire developed by Wyatt [33], as described previously [17, 18]. In addition to these questions, basic socio-epidemiological data and other ACE (i.e., emotional abuse, substance abuse in family members, mentally handicapped family members, family members at risk for suicide, and family members in prison) were explored. Other adverse experiences were examined as some of the health problems attributed to CSA may actually result from a combination of different abuse experiences [20]. In addition, physical abuse during childhood (yes/no) including consequences of physical abuse, that is, pain, bruises, cuts, burns, fractures, and/or others to specify in a free text answer was investigated. Sexual, physical abuse, and other ACE were coded independent from each other as dichotomous variables. These dichotomous variables were used for further statistical analysis.

Educational level was evaluated with a question on profession offering seven pre-selected categories and a free text answer to enter the precise profession [17, 18]. Marital status had to be rated as single, married/cohabiting, divorced, or widowed. Risk factors and risk behaviors such as smoking, alcohol abuse, drug abuse, partner smoking, partners drug abuse, physical, sexual, and emotional abuse during pregnancy as well as depression and suicidal ideation were investigated using yes/no answers. This information was related to the time of the index-pregnancy. All information including answers on partners' drug abuse and on intimate violence was based on the study participants' judgment.

The questionnaire for women with and without CSA experiences was identical. For exposed and unexposed women, data related to the index-pregnancy were evaluated for the present study. In case

of any negative emotions resulting from completion of the questionnaire, participants were invited to receive support from a psychotherapeutically experienced health care provider, whose contact details were presented in the written information on the study.

### Medical data

Gestational age at delivery (completed gestational weeks) and birth weight (g) had to be extracted from the "Mutterpass", a continuous written documentation of each prenatal consultation any pregnant women in Germany receives from her obstetrician. Women who gave birth prior to the 37<sup>th</sup> gestational week were defined as delivering prematurely. Children below the 10<sup>th</sup> birth weight percentile were classified as having an abnormally low birth weight. Information on the following pregnancy complications such as hypertensive disorders in pregnancy, thrombosis/embolia, chronic nephropathy, and diabetes were also derived from the "Mutterpass".

### Ethics

The study was conducted according to the declaration of Helsinki, the local ethics committee approved the study and women gave their informed consent to participate. Each woman was told that participation was voluntary and could be withdrawn any time.

### Statistical analysis

The Student's *t*-test and the Mann-Whitney test were chosen to investigate differences in continuous variables for example for age and the number of children (means). Differences in proportions as for ethnicity, marital status, professional status, risk factors/behavior during pregnancy, and perinatal outcome were analyzed using the Fisher's exact and the  $\chi^2$ -test. A *P*-value <0.05 was defined as statistically significant. Premature delivery, that is, prior to the 37<sup>th</sup> gestational week, as well as birth weight below the 10<sup>th</sup> percentile were used to evaluate unfavorable pregnancy outcome. Associations between CSA, physical abuse, and other ACE as well as risk factors/behavior during pregnancy were assessed by multiple logistic regression models based on a forward regression using *P*<0.05 as the entry criterion. First-order interactions were assessed with the likelihood ratio test. As the woman's occupation was correlated with obstetrical risk factors in univariate analysis, it was included as a confounder.

The Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 20.0; IBM Corp., Armonk, NY, USA) was chosen for data analysis. With one degree of freedom and an effect size of 0.8 power of the analysis for the comparison of women with and without CSA experiences was above 0.9.

### Results

Completed questionnaires were returned by 85 (76.6%) of the women with CSA experiences (i.e., exposed women)

and 218 (91.2%) of the unselected women recruited in kindergartens or presenting for routine gynecological care. The latter group included 48 (19.9%) women with CSA experiences, which were excluded from the evaluation leaving 170 (71.1%) control women (i.e., unexposed women) for statistical analysis. Details of the recruitment process are summarized in Figure 1. As a result of matching differences in the average age of women in years at the index-pregnancy ( $26.6 \pm 5.2$ ,  $27.5 \pm 3.9$ ,  $P=0.1243$ ) as well as their average number of children ( $1.9 \pm 0.9$ ,  $1.9 \pm 0.9$ ,  $P=1$ ) were not statistically significant. Most of the women in both groups were Caucasians (98.8%/99.4%,  $P=0.8$ ). The average time between the beginning of CSA and the index-pregnancy was 22.7 (range 0.5–40) years. Altogether 22 (25.9%) of the women with CSA experiences and 30 (17.6%) of the women without CSA experiences had experienced abortion prior to their first pregnancy resulting in a life birth ( $P=0.1392$ ). During pregnancy 62.4% ( $n=52$ ) of the women exposed to CSA and 95.9% ( $n=163$ ) of the unexposed women were either married or in a stable relationship ( $P<0.0001$ ).

A total of 34 (40%) of women with a history of CSA and 22 (12.9%) of the women without such a history had experienced physical abuse during childhood ( $P<0.001$ ). Out of these, all women had experienced pain and 28.2% ( $n=24$ ) bruises, cuts, burns, and/or fractures. Other ACEs were reported by 47 (55.3%) of the women with CSA experiences and by 18 (10.6%) of those without ( $P<0.001$ ).

Risk behavior and other risk factors during pregnancy are summarized in Table 1. A total of 15 (17.6%) women with CSA experiences reported physical and/or sexual abuse during pregnancy compared to none of the women without such experiences ( $P<0.001$ ). Depression

and/or suicidal ideation were experienced by 22 (25.9%) of the exposed and three (1.8%) of the unexposed women ( $P<0.001$ ). Diseases associated with increased risk for unfavorable pregnancy outcome such as hypertension, thrombosis/embolia, and/or chronic nephropathy were present in 5.9% ( $n=5$ ) of the exposed women and 4.1% ( $n=7$ ) of the unexposed women respectively ( $P=0.08$ ). One (0.6%) of the unexposed women and two (2.4%) of the women with a positive history for CSA suffered from diabetes during pregnancy ( $P=0.26$ ).

Out of the total number of 255 children, 30 (13.3%) were born prematurely. Women exposed to CSA showed a significantly higher number of children delivered prematurely than unexposed women (18.8%/8.2%,  $P=0.0239$ ). The number of children with birth weights below the 10<sup>th</sup> percentile was four in women with CSA experiences and four in control women, which was not statistically significant (4.7%/2.4%;  $P=0.4520$ ).

Results from logistic regression analysis to evaluate the association of childhood experiences and different obstetrical risk factors outcome are summarized in Table 2. CSA showed an association with physical and emotional abuse as well as depression during pregnancy. Physical abuse experiences during childhood were associated with a 1.1–1.2-fold increase for smoking, drug abuse of partner physical, sexual, and emotional abuse during pregnancy, as well as depression and suicidal ideation during pregnancy. ACE showed an association with drug abuse of the partner.

CSA, physical abuse as well as other ACE were associated with an increased risk for premature delivery (Table 3). In addition, the risk factors physical and/or sexual abuse during pregnancy, emotional abuse during pregnancy, and depression/suicidal ideation during pregnancy showed an association with an increased risk for premature delivery. As there were only eight (3.6%) children below the 10<sup>th</sup> birth weight percentile, our study group did not allow any analysis of the association between the investigated risk factors and the risk for an abnormally low birth weight.

**Table 1** Risk behavior and risk factors during the index-pregnancy.

	Women exposed to CSA n=85 (%/n)	Women not exposed to CSA n=170 (%/n)	P-value
Smoking <sup>a</sup>	31.7% (27)	9.4% (16)	<0.0001 <sup>b</sup>
Partner smoking <sup>a</sup>	37.6% (32)	28.8% (49)	0.2 <sup>b</sup>
Alcohol <sup>a</sup>	11.7% (10)	8.2% (14)	0.37 <sup>c</sup>
Drug abuse <sup>a</sup>	2.4% (2)	0	0.11 <sup>c</sup>
Partners drug abuse <sup>a</sup>	10.6% (9)	1.2% (2)	0.001 <sup>c</sup>
Physical abuse <sup>a</sup>	16.5% (14)	0	<0.0001 <sup>c</sup>
Sexual abuse <sup>a</sup>	12.9% (11)	0	<0.0001 <sup>c</sup>
Emotional abuse <sup>a</sup>	44.7% (38)	1.7% (3)	<0.0001 <sup>b</sup>
Depression <sup>a</sup>	24.7% (21)	1.8% (3)	<0.0001 <sup>b</sup>
Suicidal ideation <sup>a</sup>	10.6% (9)	0	<0.0001 <sup>c</sup>

<sup>a</sup>Yes/no answers based on the study participants' judgment; <sup>b</sup>evaluated by  $\chi^2$ -test; <sup>c</sup>evaluated by Fisher's exact test. CSA=childhood sexual abuse.

## Discussion

According to the presented results, women exposed to CSA have a higher number than unexposed women of obstetrical risk factors, such as smoking, intimate violence, and depression/suicidal ideation during pregnancy. They also proved to have an augmented risk for premature delivery. Physical abuse experiences were associated with an increased probability for all tested risk factors during



**Table 2** Multivariate Logistic Regression to evaluate the role of adverse and abusive childhood experiences in risk factors for unfavorable pregnancy outcome.

	Percentage positive for risk factor	Odds ratio	95% CI	P-value
<b>Smoking (n=43)</b>				
Childhood experiences				
CSA (n=85)	27 (31.8%)	1.1	0.929–1.255	0.3195
Physical abuse (n=56)	26 (46.4%)	1.2	1.025–1.409	0.0245
Others <sup>a</sup> (n=65)	13 (20.0%)	1.0	0.926–1.164	0.5194
Age	–	1.0	0.988–1.001	0.6283
Number of children	–	0.9	0.889–0.989	0.0148
Occupation <sup>b</sup>	–	1.0	0.981–1.038	0.5309
<b>Drug abuse of partner (n=11)</b>				
Childhood experiences				
CSA	9 (10.6%)	1.0	0.892–1.055	0.4766
Physical abuse	9 (16.1%)	1.2	1.069–1.278	=0.0007
Others <sup>a</sup>	8 (12.3%)	1.1	0.995–1.130	0.0723
Age	–	1.0	0.993–1.026	0.6028
Number of children	–	1.0	0.949–1.011	0.0767
Occupation <sup>b</sup>	–	1.0	0.99–1.02	0.88
<b>Physical abuse during pregnancy (n=14)</b>				
Childhood experiences				
CSA	14 (16.5%)	1.1	1.004–1.205	0.0414
Physical abuse	12 (21.4%)	1.1	1.039–1.261	0.0068
Others <sup>a</sup>	7 (10.8%)	1.0	0.940–1.081	0.8221
Age	–	0.99	0.987–0.998	0.0122
Number of children	–	1.0	0.978–1.037	0.6313
Occupation <sup>b</sup>	–	1.0	0.975–1.009	0.3601
<b>Sexual abuse during pregnancy (n=11)</b>				
Childhood experiences				
CSA	11 (12.9%)	1.1	0.972–1.145	0.1962
Physical abuse	9 (16.1%)	1.1	1.045–2.711	0.0035
Others <sup>a</sup>	6 (9.2%)	1.0	0.966–1.094	0.3865
Age	–	0.99	0.988–0.998	0.0043
Number of children	–	1.0	0.981–1.034	0.6054
Occupation <sup>b</sup>	–	1.0	0.974–1.005	0.1693
<b>Emotional abuse during pregnancy (n=41)</b>				
Childhood experiences				
CSA	38 (44.7%)	1.4	1.220–1.585	0.0001
Physical abuse	29 (34.1%)	1.2	1.071–1.437	0.0036
Others <sup>a</sup>	22 (25.9%)	1.0	0.886–1.082	0.6818
Age	–	1.0	0.987–1.003	0.2212
Number of children	–	1.0	1.012–1.056	0.5840
Occupation <sup>b</sup>	–	1.0	0.973–1.022	0.8265
<b>Depression (n=24)</b>				
Childhood experiences				
CSA	21 (24.7%)	1.2	1.029–1.301	0.0149
Physical abuse	16 (28.6%)	1.2	1.043–1.336	0.0092
Others <sup>a</sup>	11 (16.9%)	1.0	0.878–2.011	0.3748
Age	–	1.0	0.993–1.008	0.8964
Number of children	–	1.0	0.971–1.047	0.6680
Occupation <sup>b</sup>	–	1.0	0.965–1.008	0.2367
<b>Suicidal ideation (n=9)</b>				
Childhood experiences				
CSA	9 (10.6%)	1.0	0.923–1.07	0.9096
Physical abuse	9 (16.1%)	1.2	1.077–1.263	=0.0002
Others <sup>a</sup>	7 (10.8%)	1.0	0.982–1.560	0.1848
Age	–	1.0	0.992–1.001	0.1692
Number of children	–	1.0	0.968–1.023	0.9462
Occupation <sup>b</sup>	–	1.0	0.985–1.013	0.8757

<sup>a</sup>Physical abuse of mother, substance abuse in family members, mentally handicapped family members, family members with risk for suicide, family members in prison; <sup>b</sup>seven categories: laborers, employees, executive managers, self-employed, house-wife, trainee/student. CI=confidence interval, CSA=childhood sexual abuse.

**Table 3** Risk factors associated with premature delivery.

Risk factors	Premature	Term	P-value
	Delivery (n=30)	Delivery (n=225)	
Childhood experiences			
CSA	16 (53%)	69 (30.7%)	0.0239
Physical abuse	12 (40%)	44 (19.6%)	0.0223
Others <sup>a</sup>	14 (46.7%)	51 (22.7%)	0.0093
During pregnancy			
Smoking	7 (23.3%)	36 (16.0%)	0.4586
Drug abuse partner	2 (6.7%)	9 (4%)	0.8525
Physical and/or sexual abuse	5 (16.7%)	10 (4.4%)	0.0246
Emotional abuse	11 (12.9%)	30 (13.3%)	0.0035
Depression/Suicidal ideation	8 (23.7%)	17 (7.6%)	0.0038

<sup>a</sup>Physical abuse of mother, substance abuse in family members, mentally handicapped family members, family members with risk for suicide, family members in prison.

pregnancy, CSA with physical and emotional abuse as well as depression during pregnancy, and ACE with drug abuse of partner during pregnancy. All types of abusive and adverse childhood experiences, physical/sexual/emotional abuse during pregnancy and depression/suicidal ideation were associated with an increased risk for premature delivery.

Retrospective as well as prospective studies have confirmed an association between CSA experiences and the risk for premature delivery even when correlations were controlled for the effect of poor prenatal care and drug abuse [22, 30, 32], an association that was also found with our data. However, the increased risk for premature delivery seems to be associated with a combination of sexual, physical and other adverse experiences during childhood as well as with obstetrical risk factors, which are related to these childhood experiences. As sexual abuse occurs more often in children with a dysfunctional family background, women with a history of sexual abuse have often also been victims of physical abuse [20]. Consequently, obstetrical caregivers should ask for any abusive or adverse childhood experience.

The presented data show interesting details on potentially mediating factors between childhood experiences and premature delivery. The negative impact of smoking on pregnancy outcome has been known for decades [13, 23]. In addition to other results [6], the presented study showed that it is not CSA itself but physical abuse, likely in combination with CSA, which seems to be relevant for this association. Smoking is known to relieve stress, unhappiness, depression, and anxiety, which can be increased during pregnancies in women with abusive childhood experiences [11]. In agreement with two other

studies [1], we could not confirm the association between CSA and alcohol or drug abuse during pregnancy found by others [6, 8, 9, 22]. It seems unlikely that underestimation of illegal drug use is responsible for our results, as this would be expected for exposed and unexposed women likewise. Furthermore, substance abuse during pregnancy has revealed to be best estimated by patients themselves even when compared with urine toxicological measurements [10]. The number of partners abusing drugs during pregnancy, was significantly higher in women with abusive and/or ACEs. To the knowledge of the authors, unfortunately, no other data on this association have been published. In agreement with other authors [1, 19], a considerable number of pregnancies were complicated by abusive relationships. Abuse during pregnancy has been confirmed as a risk factor for reduced perinatal outcome for example premature delivery [2, 27]. Results from a meta-analysis showed a 1.4 times greater odds of giving birth to a low weight infant in women exposed to abuse during pregnancy compared to unexposed women [21]. Depression, especially when associated with intimate partner violence, has been proven to further increase the risk for unfavorable pregnancy outcome [7, 27]. Farber et al. [5] hypothesized that in women with CSA experiences pregnancy may reactivate feelings of helplessness and create fears to be unable to protect the child from similar experiences. In such situations, fantasies of the death of oneself and the unborn infant might be perceived as a solution. Our results are in line with those of other authors who showed an association between a history of CSA and an increased risk for depression [14] as well as suicidal ideation [31] during pregnancy. The increase of the risk for prenatal depression following CSA is reported to be 2.6-fold [25], the increase following lifetime physical or sexual abuse to be 1.5-fold, and 1.7-fold, respectively [24].

Several factors limit the generalizability of our results. First, the study design does not allow evaluation of the causal links between the evaluated risk factors and premature delivery. As women with CSA experiences who actively searched for psychological support were evaluated, results for this group will likely differ from a study group including any women exposed to CSA. In addition, the selected women show a variety of known risk factors for long-term consequences of CSA [3]. However, such high-risk groups give us the opportunity to better understand long-term consequences of CSA. Possibly some women in the control group will have experienced but not memorized CSA, which would lead to underestimation of group differences. Recall bias cannot be ruled out as results are (i) self-reported and (ii) the interval between the

index-pregnancy the realization of the study was several years. Nonetheless, several studies confirm that retrospective collection of information on smoking patterns and other pregnancy experiences is reliable independent from recall time and the outcomes studied [12, 29]. Due to lack of a validated questionnaire, a self-developed questionnaire without data on reliability and validity had to be used. Especially data on depression and suicidal ideation, which were based on the subjective estimation of each woman, have to be interpreted with caution. Although reliability and validity of the Wyatt questionnaire is not known, CSA experiences should be very reliable as they were additionally investigated in a therapeutical setting. As the power for the analysis of the association between abuse experiences during childhood and different risk factors during pregnancy is limited, these results have to be interpreted with caution.

The sample was quite homogenous with regard to severity of CSA and ethnicity, thus allowing a reliable analysis of this specific group. Another strength was the availability of a control group without CSA experiences matched for age and the number of children. Furthermore, the studied sample is one of the largest exploring perinatal risk factors in women exposed to CSA. To our knowledge, this is the first study investigating the association between exposures to different types of childhood abuse as well as other ACEs and relevant risk factors for an unfavorable pregnancy outcome systematically. As the number of low weight infants was rather small in the presented study group, we were unable to investigate the direct association

between the investigated risk factors and birth weight on a reliable basis. However, in line with recently published data on the effect of posttraumatic stress disorder resulting from a childhood abuse history on gestational age at delivery [28], our study confirms a strong association between abusive and other ACE and premature delivery. Larger longitudinal studies will have to confirm causal links as well as interactions between the investigated risk factors/behavior and perinatal outcome. However, recent results showing increased cortisol awakening responses, that is, a dysregulation of the hypothalamic-pituitary-adrenal axis might explain the underlying pathophysiological mechanism for causal relations between abusive childhood experiences and adverse pregnancy outcome [4].

Women with a positive history of childhood abuse experiences may present a modified health risk behavior and a specific profile of risk factors, which interferes with a successful pregnancy. This includes smoking, a higher rate of physical, sexual, and/ or emotional abuse during pregnancy as well as depression and suicidal ideation. Women with abuse experiences show an increased risk for premature delivery. To implement adequate primary care for the mother and the child obstetrical caregivers should be aware of the particular risk factors for unfavorable pregnancy outcome following CSA, physical abuse as well as other ACEs.

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